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Subcommittee on Fisheries Conservation, Wildlife & Oceans

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Witness Statement

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Mr. Chairman and Members of the Subcommittee, thank you for inviting me to this hearing on ecosystem-based fishery management. I am Patricia A. Livingston, Program leader of Resource Ecology and Ecosystem Modeling at the Alaska Fisheries Science Center of the National Marine Fisheries Service (NMFS).

Implementing Ecosystem-Based Fisheries Management: The Alaskan Experience

Implementing ecosystem-based fishery management requires an expansion of our fishery management advice beyond assessments of species that are targets of fisheries. Although there have been advances in multispecies and ecosystem modeling approaches, these approaches have not yet been completely embraced by the scientific community for purposes of fishery management. In some cases this is so because of the difficulties in validating these models and in other cases because of the lack of sufficient data and knowledge of the critical processes to develop an appropriate model.

We are making progress, however, in providing ecosystem advice to managers while we wait for these approaches to mature. There are many GLOBEC and GLOBEC-like research efforts going on throughout the world, which bring oceanographers, marine ecologists, and fisheries scientists together to examine the potential impact of global climate change on ocean ecosystems. Coordinated ecosystem research programs along these lines are being conducted in the Gulf of Alaska through the U.S. GLOBEC program, which is seeking to understand effects of climate variability on marine production, particularly looking at salmon and zooplankton. NMFS and NOAA's Office of Oceanic and Atmospheric Research have been working together in Alaska to understand the effects of climate on pollock production through its Fisheries Oceanography Coordinated Investigations joint program. These programs have highlighted the significant gaps in knowledge in the link between zooplankton and fish production. There is also increasing emphasis on habitat research, ongoing trophic interactions work, and long-term monitoring of non-commercial species, which all provide useful information on ecosystem status and trends. Some of this ecological information can be used to gauge the success of various management schemes that have been put in place to meet ecosystem-based management goals that have been put forward by the scientific community.

The Alaska Fisheries Science Center and other collaborators have provided the North Pacific Fishery Management Council (NPFMC) with some of this ecosystem research information in an Ecosystems Considerations document that accompanies the traditional single-species stock assessment advice to the Council. We have also just completed a draft programmatic Supplemental Environmental Impact Statement (SEIS) for our Alaskan groundfish fisheries that provides a comprehensive analysis of our present knowledge of the effects of the groundfish fisheries on the environment. This draft programmatic SEIS takes a broad view of the present fishery management regime and examines policies and potential future actions

from a variety of environmental perspectives. A comprehensive Biological Opinion on Alaskan groundfish fisheries provides a protected species impacts analysis and management approaches to be used to avoid jeopardy under the Endangered Species Act. A broad range of scientific expertise is required to provide the ecosystem-based advice in these types of documents. I will discuss aspects of these documents, their relationship to development of ecosystem-based fishery management plans, and some of the present gaps in our scientific knowledge.

Ecosystem Considerations Chapter

The North Pacific Fishery Management Council's Groundfish Plan Teams began in 1994 to broaden the scientific information provided to the plan teams beyond the single-species stock assessment advice contained in the Stock Assessment and Fishery Evaluation Report (SAFE) provided to the Council. A new Ecosystem Considerations Chapter was added to this SAFE document. Originally, the chapter contained information summarizing ecosystem-based management objectives from recent research articles, status and trend information of protected marine mammal species such as Steller sea lions and northern fur seals, and research summaries of a variety of ecosystem-related research. There was not much standardization of the content of the report from year to year. However, it served as information to the plan teams and as a vehicle for discussing research priorities.

Three years ago, NMFS proposed that the chapter serve as an ecosystem status and trends document with a more standardized content from year to year. The idea was to draw upon a broad range of scientific experts in the areas of physical oceanography and climate, biological oceanography, habitat and effects of fishing research, marine pollution, predator-prey interactions, forage fish and other non-target species, and marine mammals and seabirds. Information would be presented on the time trends of these ecosystem components in the document and discussion would include the possible factors influencing change. Experts providing information to this chapter include those from NMFS, other NOAA components, state agencies, U.S. Fish and Wildlife Service, academia, and those representing native or other local-based knowledge groups.

The purpose of these ecosystem status and trends indicators is to 1) bring the results of ecosystem research efforts to the attention of stock assessment scientists and fishery managers in order to provide stronger links between ecosystem research and fishery management and 2) bring together many diverse research efforts into one document, which would spur new understanding of the connections between ecosystem components and the possible role that climate, humans, or both may have on the system.

In addition to the ecosystem status and trend information, NMFS proposed that the document also contain ecosystem management indicators. These indicators would be ones that measure how we are meeting ecosystem-based management goals. The indicators would: 1) provide early signals of direct human effects on ecosystem components that might warrant intervention by management or 2) provide evidence of the efficacy of previous management actions. The North Pacific Fishery Management Council adopted an ecosystem policy that has the following four ecosystem-oriented management goals and the indicators are arranged to measure aspects of the management system that could influence achievement of those goals.

1. Maintain **biodiversity** consistent with natural evolutionary and ecological processes, including dynamic change and variability.

2. Maintain and restore **habitats** essential for fish and their prey.

3. Maintain system **sustainability** and sustainable yields for human consumption and non-extractive

uses.

4. Maintain the concept that **humans** are components of the ecosystem.

For example, Exhibit 1 shows an ecosystem measure, trophic level of the catch, that can be used to examine whether we are "fishing down the food web," an issue related to system biodiversity and sustainability. We have now completed two annual revisions of the more standardized ecosystem considerations document of the NPFMC (Livingston 1999, 2000). The documents are available on the web at:

http://www.refm.noaa.gov/docs/ecocons99.pdf

http://www.refm.noaa.gov/docs/Ecocon2000.pdf

NMFS is working closely with the North Pacific Fishery Management Council to apply ecosystem level information to fishery management decisions. The Ecosystem Considerations Chapter now contains some parts of a Fishery Ecosystem Plan such as ecosystem status and trend information for many ecosystem components. It also has management indicators such as: amount of habitat closed to fishing, changes in the amount of fishery discards over time, and trophic level of the catch. The document provides a way for ecosystem research scientists from a variety of organizations to inform stock assessment scientists of their results and for managers to link management actions with ecosystem observations and ecosystem-based management goals such as protection of habitat, maintaining diversity, and sustainability.

Future work includes the development of more quantitative management objectives and ecosystem indicators linked to management triggers. Semi-quantitative approaches, such as those used in Environmental Impact Analysis, linked to a pre-negotiated set of management actions are now being discussed by the scientific community (e.g., Caddy 1999; Koeller et al. 2000). This is a key step needed to advance this ecosystem considerations chapter beyond research communication towards a true ecosystem assessment that triggers ecosystem-based management actions.

Draft Alaska Groundfish Fisheries Programmatic Supplemental Environmental Impact Statement (SEIS)

The National Environmental Policy Act (NEPA) requires federal agencies to analyze potential impacts of federal actions on the environment. The draft SEIS examines the impacts of the authorization of the groundfish fisheries off Alaska. It is an ecosystem-based assessment in that it covers the broad range of issues from the effects of groundfish fisheries on the decline of sea lions and other protected species, the effects of fishing gear on benthic habitat, excess fishing and processing capacity, target and non-target species effects, and the effects of harvesting on the North Pacific marine ecosystem. The programmatic SEIS identifies and evaluates combinations of management tools available for improving the fishery management regime with respect to protecting and conserving various ecosystem components and increasing socioeconomic benefits.

The SEIS document also contains virtually all of the elements of a Fisheries Ecosystem Plan as outlined by the Report of the NMFS Ecosystem Advisory Panel including:

- Delineation of the ecosystems within Council authority, including characterization of the biological, chemical and physical dynamics of those ecosystems (Chapter 3)
- Description of the food webs of the ecosystems (Chapter 3)

- Description of the life history characteristics and known habitat needs of different life stages of animals (Chapter 3)
- Total fishery removals including incidental mortality and assessment of how those relate to ecosystem effects (Chapters 2 and 4)
- A description of the fisheries management plan policy statements, goals, and objectives that includes how uncertainty is included in conservation and management actions (Chapter 2)
- Ecosystem indicators are used in the assessment process (Chapter 4)
- Description and, through the cumulative effects analysis, an assessment of the ecological and human elements of the ecosystem which most significantly affect fisheries (Chapter 4)

The status quo fishery management regime is explained and evaluated with respect to the performance standards for fishery management outlined in the *Sustaining Marine Fisheries* report of the National Research Council. It is clear from this evaluation that Alaska has already accomplished a great deal in terms of ecosystem-based management through conservative single species management (Exhibit 2), establishment of substantial no-trawl zones (Exhibit 3), programs to reduce overcapacity , significant controls on discards and monitoring of bycatch (Exhibit 4), and reducing fishery interactions with protected species. The North Pacific Fishery Management Council has established an Ecosystem Committee, whose purpose is to discuss and recommend possible approaches to incorporating ecosystem concerns into the fishery management process and to provide the Council and stakeholders with information on ecosystem-based management in the North Pacific Ocean. Other precautionary measures that have been taken include a 2 million mt per year optimum yield upper limit to restrict total allowable catch of the Bering Sea groundfish complex, a prohibition on new fisheries for forage fish species, and designating sensitive bottom organisms such as corals and sponges as prohibited species.

It is intended that the programmatic SEIS will serve as the central environmental planning document for both the BSAI and GOA Groundfish FMPs, which are presently not oriented to promote ecosystems. The full document can be viewed on the web at:

http://www.fakr.noaa.gov /sustainablefisheries/seis/intro.htm

The SEIS is Alaska's most complete analysis to-date of our scientific understanding of the effects of groundfish fisheries on the environment and it highlighted many of our gaps in knowledge in determining ecosystem effects, particularly in a quantitative way. We had incomplete knowledge of the seasonal distribution and habitat needs of important groundfish in order to make determinations of how protection of habitat might improve stock abundance. Similarly, lack of knowledge of both the seasonal foraging requirements of Steller sea lions and the seasonal changes in distribution of key prey stocks such as walleye pollock and Pacific cod prevented us from making quantitative assessments of the effect of fishing removals of these species on Steller sea lions. The effects of fishing on benthic habitat research is just beginning and we require additional work to understand how fishing gear and fishing removals affect benthic diversity. Increased benthic habitat mapping in conjunction with fishing gear experiments are needed. Although we have a variety of predator-prey models, we need data at finer space and time scales and better knowledge of the space/time distribution of prey, particularly forage fish and zooplankton to determine how predators may switch according to prey availability. More research on non-target species distribution and taxonomy in association with improvements to our fishery reporting system are needed to move some of these species into tier 1 assessments defined in the NMFS Stock Assessment Improvement Plan. Moving towards more quantitative or semi-quantitative analyses on which to base our ecosystem-based management advice and to advance our stock assessments beyond tier 1 will require additional research along these lines.

Comprehensive Biological Opinion on Alaska Groundfish Fisheries

NMFS has put considerable effort into analyzing ecosystem level impacts of fisheries pursuant to the requirements of the ESA. On November 30, 2000, NMFS released a biological opinion which evaluates the impacts of Alaskan groundfish fisheries on listed species. The purpose was to determine if the FMP framework contained the necessary conservation and management measures to insure protection of listed species and their critical habitats. The scientific analysis in this opinion was qualitative and highlighted our lack of understanding of seasonal distribution of key Steller prey and the seasonal distribution and foraging needs of Steller sea lions.

The comprehensive biological opinion provides conservation recommendations to minimize or avoid adverse effects of a proposed action. Key conservation recommendations were first to expand stock assessments to consider space/time distribution of stocks and removals and include environmental influences on fish stock distribution and abundance. Multispecies considerations and risk analyses would also be included as part of the growing trend towards a "comprehensive assessment" process. Fishery rationalization programs for all groundfish fisheries were also recommended to reduce the "footprint" of fisheries at smaller time/space scales. Appropriate improvements to the existing catch monitoring programs (i.e, observer program, reporting and record keeping requirements, and vessel monitoring programs) would also be necessary. Many of these recommendations are also being made under the NMFS Stock Assessment Improvement Plan.

Relationship to Ecosystem-based Fishery Management Plans

As we discussed in the analysis contained in the programmatic SEIS, we are moving incrementally towards ecosystem-based fishery management plans with various ecosystem-based plan amendments. Both the programmatic SEIS and Comprehensive Biological Opinion for Alaska Groundfish Fisheries have identified possible policy directions for further improvement of ecosystem-based management under NEPA and ESA and showed the qualitative status of our ecosystem-based scientific advice. With the addition of a more structured assessment framework similar to that used in the programmatic SEIS, the Ecosystem Considerations Chapter of our SAFE has potential for providing year-to-year advice in meeting our NEPA obligations for TAC setting. Improvements in stock assessments identified by NMFS will advance our ecosystem-based management advice and allow single-species stock assessments to be embedded in an ecosystem context in a more quantitative way. Key to all these activities is involvement of a broad spectrum of scientific expertise to reflect concerns beyond species that are targets of fisheries and enhancing our research to include those broader concerns.

Research and Data Gaps

Some important research and data gaps identified in the programmatic SEIS, comprehensive Biological Opinion, and Ecosystem Considerations Chapter include research and data collection on:

- structure and functioning of marine ecosystems (including: the role of habitat, predator-prey interactions, factors affecting stability and resilience including mechanisms at the population and community levels of organization, and effects of fishing on benthic habitat and overall ecosystems)
- long-term research and fishery independent monitoring programs on target and non-target species, oceanography and climate, and habitat mapping
- development of fishery stock assessment models that incorporate unobserved fishing mortality, environmental variability, spatial distribution of fish and fisheries removals, and multispecies interactions

- biological effects of fishing on gene pools and population structures
- marine protected areas and using MPAs as research tools
- extent and nature of Steller sea lion foraging habitat
- effects and effectiveness of various forms of rights-based management approaches
- improvement in the observer program, reporting and record keeping requirements, and vessel monitoring programs
- overall improvement in the research and data collection efforts with regard to understanding processes at finer time and space scales

Summary

The Alaska region has done extensive work on analyzing and incorporating ecosystem-based management objectives into its fisheries management but we still have far to go. These analyses have many of the components identified in a Fisheries Ecosystem Plan as envisioned by the NMFS Ecosystem Advisory Panel Report. We have identified policy directions and management actions that need to be taken to make substantial progress in moving towards more prescriptive and adaptive ecosystem-based fishery management plans. We are broadening our stock assessment advice to include ecosystem-based research and will be working towards identifying more quantitative ecosystem-based management objectives and ecosystem indicators linked to management triggers and actions. Increased ecosystem-based research and involvement of multidisciplinary analysis and management teams are key to the process.

Conclusion

Mr. Chairman, this concludes my testimony. Again, I want to thank you for the opportunity to testify today and discuss ecosystem-based management. I am prepared to respond to any questions that you and other Members of the Committee may have.

References

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